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Research Notes : Underground pods in Glycine falcata Benth

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the same material which gives the seeds a dull luster, whereas other varieties have little or none and exhibit a shiny seed coat. In soybean or any plant, the response of genotypes to space and to immediate neighbors constitutes a major component of reproductive ability. The differential response to space has been exploited successfully, at least with some genotypes, by utilization of narrow rows for commercial production. In the Middle East soybean production I have noticed the following: Up to 70% of the flowers produced by the plants may fall on the ground. The tendency of perfectly healthy flowers to abort is a major concern of the soybean workers. The technique for preventing this loss is not known yet. The plant loses more blossoms during periods of hot dry weather than in more favorable conditions. However, weather and fertility conditions that may be considered ideal still result in much flower drop. Therefore, the main reason for this drop is still unknown.

The Lee variety of soybean is highly popular in our area and is mainly preferred by our farmers.

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1) Underground pods in *Glycine falcata* Benth.

The genus *Glycine* L. has been divided into three sub-genera, namely *Glycine* L., *Bracteata* Verdc., and *Soja* (Moench) F. J. Herm. (Hymowitz, 1970). *G. falcata* of 1864 was the last of the true *Glycine* species to be described by Bentham (Hermann, 1962). *G. falcata* is one of the six species belonging to the sub-genus *Glycine* L. *G. falcata* appears to be restricted to Australia (Newell and Hymowitz, 1978).

From T. Hymowitz of the University of Illinois seeds of two *G. falcata* accessions (PI 233,139 and PI 246,519) were received. Scarified seeds were sown on 6 June 1979 in a 10 cm petri dish on a moistened filter paper. The seeds germinated on 9 June 1979. The seedlings were transplanted to 15 cm diameter pots containing a mixture of field soil : compost : sand : and rice straw in 1:1:1:1 ratio. The plants were exposed to 10 hr sunlight and then given 14 hr darkness every day. PI 246,519 flowered and produced mature pods in 114 and 155 days after sowing, respectively. PI 233,139 flowered in 77 days and matured in 117 days.

The plants continued growth. Both the accessions produced roots at stem nodes in contact with the soil thereby giving rise to vegetatively reproduced daughter populations. In most of wild Glycine species such phenomena have been reported (Newell and Hymowitz, 1978). However, on G. falcata (PI 233,139) in addition to rooting at stem nodes, the nodes also bore almost sessile flowers in a cluster of 1 to 3. These flowers, since they are white in color, can be easily mistaken for root initials. The mature flower is about 4 to 5 mm in length. The calyx is appressed to the corolla and brown in color. The pedicels are very short, about 0.5 to 1.0 mm in length. Flowers are cleistogamous. The flowers remain inside the soil. Pods also developed inside the soil. The developing pods can be easily mistaken for Rhizobium root nodules. So far three pods have been harvested. All of them have developed from monocarpellary ovary. Pods are tan colored, 7 mm long with 4 mm maximum width. Each pod contained only one seed. Seed was yellow in color, 4 mm long and 2 mm wide. In contrast, the above-ground seed coat had black seed coat color with the same dimensions. PI 233,139 also produced normal flowers and three- to four-seeded pods above ground as described by Hermann (1962). Similar underground and above-ground pods have been reported in G. falcata (Everist, 1951; Hymowitz and Newell, 1975) and in the genus Amphicarpaea edgeworthii Benth. var. japonica Oliver which is called Yabumame in Japanese.

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References

Everist, S. L. 1951. Notes on some plants of western Australia, Queensland Nat. 14(3): 52-53.

Hermann, F. J. 1962. A revision of the genus Glycine and its immediate allies. USDA Tech. Bull. 1268: 1-79.

Hymowitz, T. 1970. On the domestication of the soybean. Econ. Bot. 24: 408-421.

Hymowitz, T. and C. A. Newell. 1975. A wild relative of the soybean. Illinois Research 17(4): 18-19.

Newell, C. A. and T. Hymowitz. 1978. A reappraisal of the sub-genus Glycine Willd. Am. J. Bot. 65(2): 168-179.

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2) Flowering of *Glycine max* (L.) Merr. with cotyledonary and unifoliolate leaves.

In 'Biloxi' soybeans the trifoliolate leaves are essential to perceive the photoperiodic inductive conditions and to cause the initiation of flower primordia (Borthwick and Parker, 1935). To respond to photoinduction, some plants have to reach "ripeness to flower" or pass the "juvenile phase" (Lang, 1965). "Juvenile phase" is distinct in some soybean cultivars, such as Acc. G 2120, while in the day-neutral soybean Acc. G 215 it is not clear whether there is a "juvenile phase" (Shanmugasundaram and Tsou, 1978). In both Acc. G 2120 and Acc. G 215 one trifoliolate leaf left on the short-day branch of a decapitated plant was able to induce flowering in both the short-day and leafless long-day branch (Shanmugasundaram *et al*., 1979). But when the long-day branch in Acc. G 2120 had four or more trifoliolate leaves the flower-inducing substance produced in the short-day branch could not induce flowers on the long-day branch (Shanmugasundaram *et al*., 1979). However, in *Pharbitis nil* (Kujirai and Imamura, 1958) and *Chenopodium rubrum* (Cumming, 1959) it has been demonstrated that the plants can be fully photoinduced at the cotyledonary leaf stage without any foliage to produce flowers. The experiment described in the present report demonstrates the flowering of a day-neutral soybean cultivar, Acc. G 215, with only the cotyledonary and the unifoliolate leaf left on the plant.

The photoperiod-sensitive soybean cultivar Acc. G 2120 and the day-neutral soybean cultivar Acc. G 215 were decapitated soon after the unifoliolate leaves emerged. Development of the two axillary buds from the unifoliolate leaf nodes was allowed. Axillary buds, if any developed at the cotyledonary leaf nodes, were removed. The plants were left in the 16-hour photoperiod. As the axillary buds developed, the trifoliolate leaves, before they unfolded, were continuously removed. The meristem was allowed to grow. From the time the branches were visible, one branch was exposed to a 10-hr photoperiod and the other branch in each plant was exposed to a 16-hr photoperiod. In one set of plants both branches were subjected to a 10-hr photoperiod. In another set of plants both branches were subjected to a 16-hr photoperiod. A set of decapitated plants with all the trifoliolate leaves present served as the control. The time from sowing to flowering of each branch and the total number of flowers produced were recorded.

Day-neutral Acc. G 215 plants with only cotyledonary and unifoliolate leaves flowered essentially in the same number of days as control plants with all the trifoliolate leaves left on the plant (Table 1). Results suggest that the total number of flowers produced in the 10-hr photoperiod with cotyledonary and unifoliolate leaves were comparable to those with all the trifoliolate leaves present in the same photoperiod. The number of flowers are determined largely by the photoperiod (Table 1). In Acc. G 215 the cotyledons and the unifoliolate leaves not only perceive the photoperiodic stimulus but also provide sufficient photosynthate to saturate complete flowering quantitatively. The 16-hr photoperiod merely increased the photosynthate to produce more flowers.

Table 1

Flowering response of two branched day-neutral soybean, Acc. G 215 with and without trifoliolate leaves

Photoperiod on the decapitated plant's branches	No. of trifoliolate leaves on the two branches	Days to flowering of the two branches++	No. of flowers on the two branches++
10 h / 10 h	0 / 0+	50 / 49	14 / 18
16 h / 16 h	0 / 0+	50 / 48	21 / 21
10 h / 10 h	4 / 4	51 / 51	16 / 19
16 h / 16 h	8 / 8	51 / 48	20 / 29
10 h / 16 h	0 / 0+	49 / 50	13 / 20

+Cotyledonary and unifoliolate leaves alone remained on the plant.

++Values are mean of 5 plants.

On the contrary, photoperiod sensitive Acc. G 2120 plants flowered only in the 10-hr branch with all the trifoliolate leaves present. The plants with only cotyledonary and unifoliolate leaves and the 16-hr branches with all the trifoliolate leaves did not flower. Therefore, it appears that flowering with only the cotyledonary and unifoliolate leaves may be under genetic control.

It is our belief that the above results constitute the first report of flowering in soybean with only cotyledonary and unifoliolate leaves in a day-neutral soybean plant. Efforts now are under way to study the role of cotyledonary leaf alone, unifoliolate leaf alone and trifoliolate leaf alone in the flowering of several day-neutral soybeans.

References

Borthwick, H. A. and M. W. Parker. 1938. Bot. Gaz. 100: 374.

Cumming, B. G. 1959. Nature 184: 1044.

Kujirai, C. and S. Imamura. 1958. Bot. Mag. (Tokyo) 71: 408.

Lang, A. 1965. Pp. 1380-1536 in W. Ruhland (Ed.), Encyclopedia of Plant Physiology. Springer-Verlag, Berlin.

Shanmugasundaram, S. and S. C. S. Tsou. 1978. Crop Sci. 18: 598.

Shanmugasundaram, S., W. C. Chin and T. S. Toung. 1979. Bot. Gaz. 140 (in press).

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1) Soybean mutation.

Since 1970, soybean radiation experiments have been conducted in Thailand. The objectives are (1) to create genetic variability in soybean cultivars by gamma radiation, and (2) to screen and to evaluate for desired characteristics with the aim of producing superior breeding lines with resistance to diseases and insects.

The purpose of this presentation is to report briefly the results obtained within a period of 1970 to 1977.

In general, the soybean seeds with moisture content between 10 and 14 percent were irradiated with gamma rays from a caesium source at the Division of Radiation and Isotopes, Kasetsart University. The M_2 seeds of each M_1 plant were usually sown as plant-to-row. The mutants were detected in the M_2 generation.

Two experiments were carried out in order to find a gamma radiation dose suitable for inducing mutation in 'Sansai' and 'S.J.2' cultivars. The doses were varied from 5 to 35 krad. It was found in one experiment that the maximum frequency of yellow seedlings in the M_2 generation occurred at 15 krad treatments. With this 15 krad dose, it was possible to obtain changes in morphological characteristics in later soybean experiments (Smutkupt, 1973; Smutkupt, 1976b). In an experiment using Sansai, 'S.J.1', S.J.2, 'Wakashima', and 'Cutler-71', yellow seedlings were observed in all cultivars with mutation